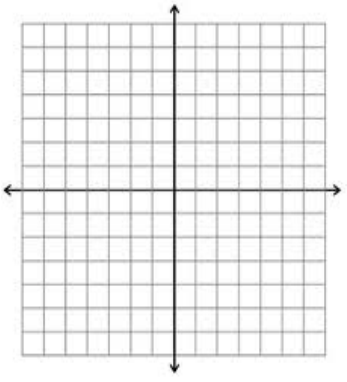
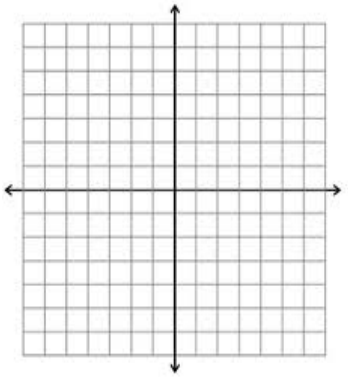
Precalc Warm Up # 2-3

Graph. Label important features. State the domain.

1. $y = \log_2(x - 2)$



2. $y = \log_2(2 - x)$



Questions: p. 227

EXERCISES 7.4

1. Without using a calculator,

(a) $\log_2 8 + \log_2 4$

(d) $\log_3 18 - \log_3 6$

2. Write down an expresion for $\log a$ in terms of $\log b$ and $\log c$ for the following.

(a) $a = bc$ → $\log a = \log bc$

$\log a = \log b + \log c$

(d) $a = b\sqrt{c}$

3. Given that $\log_a x = 0.09$, find

(a) $\log_a x^2$

4. Express each of the following as an equation that does not involve a logarithm.

(a) $\log_2 x = \log_2 y + \log_2 z$

(c) $\log_2(x+1) = \log_2 y + \log_2 x$ → $\log_2(x+1) = \log_2(xy)$

$x+1 = xy$

(e) $\log_2 y = \frac{1}{2}\log_2 x$

5. Solve the following equations

(a) $\log_2(x+1) - \log_2 x = \log_2 3$

(b) $\log_{10}(x+1) - \log_{10} x = \log_{10} 3$

(c) $\log_2(x+1) - \log_2(x-1) = 4$

(d) $\log_{10}(x+3) - \log_{10} x = \log_{10} x + \log_{10} 2$

(e) $\log_{10}(x^2+1) - 2\log_{10}x = 1$

(f) $\log_2(3x^2+28) - \log_2(3x-2) = 1 \rightarrow \log_2\left(\frac{3x^2+28}{3x-2}\right) = 1$

(g) $\log_{10}(x^2+1) = 1 + \log_{10}(x-2)$

(h) $\log_2(x+3) = 1 - \log_2(x-2)$

$2 = \frac{3x^2+28}{3x-2}$

$6x - 4 = 3x^2 + 28$

$0 = 3x^2 - 6x + 32$

(i) $\log_6(x+5) + \log_6 x = 2$

(j) $\log_3(x-2) + \log_3(x-4) = 2 \rightarrow \log_3(x-2)(x-4) = 2$

(k) $\log_2 x - \log_2(x-1) = 3\log_2 4$

(l) $\log_{10}(x+2) - \log_{10}x = 2\log_{10}4$

$3^2 = x^2 - 6x + 8$

$0 = x^2 - 6x - 1$

$9 + 1 = x^2 - 6x + 9$

$\pm\sqrt{10} = \sqrt{(x-3)^2}$

$x = 3 \pm \sqrt{10}$

6. Simplify the following

(a) $\log_3(2x) + \log_3 w$

(c) $2\log_a x + 3\log_a(x+1)$

(e) $\log_{10}x^3 + \frac{1}{3}\log(x^3y^6) - 5\log_{10}x$

$\log_{10}x^3 + \log_{10}(x^3y^6)^{\frac{1}{3}} - \log_{10}x^5$

$\log_{10}x^3 + \log_{10}xy^2 - \log_{10}x^5$

$\log_{10}\left(\frac{x^3 \cdot xy^2}{x^5}\right)$

$\log_{10}\left(\frac{y^2}{x}\right)$

8. Solve for x.

(a) $\log_2 x^2 = (\log_2 x)^2$ (b) $\log_3 x^3 = (\log_3 x)^3$

(c) $\log_4 x^4 = (\log_4 x)^4$ (d) $\log_5 x^5 = (\log_5 x)^5$

Investigate the solution to $\log_n x^n = (\log_n x)^n$

b) let $y = \log_3 x$ $0 = y^3 - 3y$

$0 = y(y^2 - 3)$

$\log_3 x = 0$ $\sqrt{(\log_3 x)^2} = \pm\sqrt{3}$

$x = 1$ $x = 3^{\pm\sqrt{3}}$

c) let $y = \log_4 x$

$0 = y^4 - 4y$

$0 = y(y^3 - 4)$

$\log_4 x = 0$ $\sqrt[3]{(\log_4 x)^3} = \sqrt[3]{4}$

$x = 1$ $\log_4 x = \sqrt[3]{4}$

$x = 4^{\sqrt[3]{4}}$

d) $x = 1$

$x = 5^{\pm\sqrt[4]{5}}$

$\log_n x^n = (\log_n x)^n$

$x = 1$ $x = n^{\sqrt[(n-1)]{n}}$

$\pm$ if $(n-1)$ is even

More practice...

Solve: $(x - 8)^{x^2 - x - 20} = 1$

$1^{\text{Any \#}} = 1$

$x - 8 = 1$

$\boxed{x = 9}$

$(\# \neq 0)^0 = 1$

$x^2 - x - 20 = 0$

$(x - 5)(x + 4) = 0$

$\boxed{x = 5, -4}$

check: $x - 8 \neq 0$

$5 - 8 \neq 0$ ✓

$-4 - 8 \neq 0$

$(-1)^{\text{even}} = 1$

$x - 8 = -1$

$\boxed{x = 7}$

check

$x^2 - x - 20$ even

$49 - 7 - 20$

22 even ✓

One more practice...

Solve: $(x - 8)^{x^2 - x - 20} = 1$

There are approximately 1500 students at South.
Suppose that during spring break, a student goes to China and contracts a contagious virus, whose spread rate is given by the logistic growth curve

$$s(t) = \frac{1500}{1+1499e^{-0.7t}}$$

s(t) is total # of students infected after t days

How many are sick after 3 days? 5 days?

South will cancel class when 40% of the kids are absent.
How long will it take for that to happen?

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$\frac{0.4(1500)}{1} = \frac{1500}{1+1499e^{-0.7t}}$

$1+1499e^{-0.7t} = \frac{1500}{0.4(1500)}$

How many are sick after 3 days? $s(3) \approx 8$ 5 days? $s(5) \approx 32$

South will cancel class when 40% of the kids are absent.
How long will it take for that to happen?

$\frac{1499e^{-0.7t}}{1499} = \frac{1.5}{1499}$

$t \approx 10$ days

Investigate...
What does this graph look like?

$$s(t) = \frac{1500}{1+1499e^{-.7t}} \qquad \frac{+}{+}$$

people infected.

positive outcomes & inputs

initial value $\longrightarrow t=0$

"zero term" $s(0) = \frac{1500}{1+1499e^{0}} = 1$

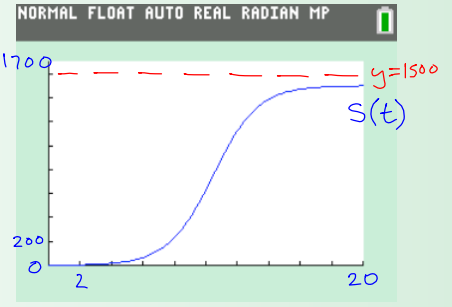
"this is person zero" $\longrightarrow$ 1 person

$$s(t) = \frac{1500}{1+1499e^{-.7t}}$$

Use known points to help determine a reasonable window

(0,1)
(3, 8)
(5, 32)
(10, 600)

window:
x-min = 0
x-max = 20
x-scl = 2
y-min = 0
y-max = 1700
y-scl = 200



HW: SL Book

p. 228 #7 LC, 9-16 LC on all

Quiz tomorrow:
PC 4.1- 4.4, SL 7.1

You may use one of my graphers, not your own.

Unit Test will be the Friday after winter break.
PC 4.1-4.5, SL 7.1, 7.4